## REMARKS

Claims 1-12 are all of the claims presently pending in this application. By the fore-going amendments, claims 1, 2 and 5 are amended. The Examiner has again allowed claims 6-12; rejected claims 1-4; and objected to claim 5, but again indicated that claim 5 would be allowable if rewritten in independent form. Claim 5 is hereby rewritten in independent form and, therefore, is believed to be allowable. Claim 1 is amended to more clearly recite the invention, and claim 2 is amended to correct minor errors.

The Examiner reinstated the 35 U.S.C. §102(e) rejection in view of Kazama, which was dropped previously as a result of the Amendment filed on November 5, 2001. The Examiner's arguments in support of that rejection are *verbatim* from the original 35 U.S.C. §102(e) rejection, with the exception of the paragraph bridging pages 3 and 4 of the Office Action, wherein the Examiner admits that Kazama does not "specifically mention preforming the steel wire to a minimum radius of curvature of 10 to 60 times its diameter" (which language was added in the November 5, 2001 Amendment). The Examiner takes the position that:

> "...the reference fails to suggest that the radius of curva-
> ture to diameter ratio is outside the range of 10 to 60.
> Absent a showing of otherwise, the steel cord of Kazama
> appears to have a radius of curvature to diameter ratio in
> the range of 10 to 60."

Applicants respectfully submit that it is improper for the Examiner to argue that Kazama teaches a feature about which it is silent. Kazama is silent regarding the claimed ratio, and it is not seen how there is any suggestion of any such feature. The Examiner seems to be shifting the burden to Applicants to prove that Kazama could not possibly have the above-noted feature. However, Applicants respectfully submit that this is impermissible. There is no reason stated by the Examiner as to why the ratio of radius of curvature to diameter in Kazama is inherently within the claimed range, nor is there any suggestion in this regard as the reference is completely silent on this issue.

According to the Examiner's arguments, the ratios of radius of curvature to diameter in Kazama were calculated with the use of numbers in Tables 7-10 therein, as follows:

- Ratio of radius of curvature to diameter = (cord diameter - wire diameter)/2/{sin (winding angle)}$^2$

- Winding angle = arc tan((cord diameter - wire diameter) x $\pi$/winding pitch)

The calculated values are shown in the attached Tables 7-10 that correspond to Tables 7-10 in Kazama, respectively. As shown in the attached Tables 7-10, the ratios of radius of curvature to diameter in Kazama are extremely deviated from the claimed range, except for sample numbers 44, 45, 53, 54 and 56 that have structures of 1 * 3-4.

Claim 1 is hereby amended to recite a steel wire "for cords having a construction of core and sheath." Support is found in the original description in the specification on page 17

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between Tables 7 and 8. As pointed out in the Response filed June 6, 2002 (see, e.g., page 3, middle paragraph), Kazama does not define a discrete core and sheath as in the present invention. Based on the foregoing amendment to claim 1 and the preceding comments, Applicants respectfully request the Examiner to remove the prior art rejection in view of Kazama.

The Examiner argues that if Kazama fails to teach or suggest the minimum radius limitation, then newly cited Obana would supply that deficiency (last four lines at the bottom of page 4 of the Office Action).

In order to remove Obana as a prior art reference against the instant application, Applicants submit concurrently herewith a verified English language translation of their priority document (JP 131387/1997 filed May 21, 1997). Such foreign priority date is prior in time to the effective U.S. filing date of Obana, which is November 24, 1997, and it is also before the publication date of Obana's PCT application, which is October 23, 1997. Accordingly, Applicants respectfully request that the rejection of claims 1-4 under 35 U.S.C. §103(as) as being unpatentable over Kazama in view of Obana be withdrawn.

In view of the preceding amendments and remarks, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If there are any points remaining in issue that the Examiner feels may be best resolved through
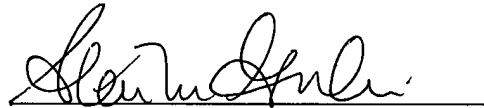
a personal or telephonic interview, he is kindly requested to contact the undersigned attorney

at the local telephone number listed below.

A Petition for Extension of Time with appropriate fee accompanies this document. The USPTO is directed and authorized to charge all additional required fees (except the Issue Fee and/or the Publication Fee) to our Deposit Account No. 19-4880. Please also credit any overpayment to said Deposit Account.

Respectfully submitted,

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WASHINGTON OFFICE

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PATENT TRADEMARK OFFICE

Date:  December 18, 2002

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## APPENDIX

## VERSION WITH MARKINGS TO SHOW CHANGES MADE

## IN THE CLAIMS:

**The claims are amended as follows:**

1.  (Twice Amended)  A steel wire <u>for cords having a construction of core and sheath</u>
comprising a wire diameter ranging from 0.10mm to 0.40mm obtained by subjecting a high-
carbon steel wire material having a carbon content ranging from 0.70% to 0.90% in weight to
heat treatment and wire drawing, said steel wire preformed to have a minimum radius of curva-
ture of 10 to 60 times its diameter, a tensile strength TS ($N/mm^2$) of the steel wire satisfies
following formula,

TS≥2250-1450logD

wherein D is the diameter of the steel wire in mm and log means common logarithm,

and that repeated torsion value RT (turns/100D) of the steel wire, which is defined as sum
of forward twisting and reverse twisting given until a crack is formed on a steel wire in a test
wherein a steel wire is subjected to a repetition of forward twisting equivalent to 3 turns per
100D and reverse twisting to the original state with the axis of the steel wire kept straight, satis-
fies following formula;

log RT≥2-0.001{TS-(2250-1450logD)}.

2.   (Twice Amended)   A steel wire according to claim 1, having tensile strength TS

[(N/mm2)] (N/mm$^2$) satisfying following [formulas] formula,

TS≥2750-1450logD.

5.   (Amended)   A method of manufacturing a steel wire [according to claim 1 com-

prising] having a diameter ranging from 0.10mm to 0.40mm obtained by subjecting a high-

carbon steel wire material having a carbon content ranging from 0.70% to 0.90% in weight to

heat treatment and wire drawing, characterized in;

that tensile strength TS (N/mm$^2$) of the steel wire satisfies following formula,

TS≥2250-1450logD

wherein D is the diameter of the steel wire in mm and log means common logarithm,

and that repeated torsion value RT (turns/100D) of the steel wire, which is defined as sum

of forward twisting and reverse twisting given until a crack is formed on a steel wire in a test

wherein a steel wire is subjected to a repetition of forward twisting equivalent to 3 turns per

100D and reverse twisting to the original state with the axis of the steel wire kept straight, satis-

fies following formula,

$\underline{\log RT \geq 2-0.001\ \{TS-(2250-1450\log D)\}}$

which comprises a step of drawing a high-carbon steel wire material after heat treatment, characterized in that the step of drawing is carried out according to following conditions;

① reduction per die is set [from] from (22.67 $\varepsilon$+3)% to 29% for dies at which $\varepsilon$ is less than 0.75,

② reduction per die is set from 20% to 29% for dies at which $\varepsilon$ is not less than 0.75 and not more than 2.25,

③ reduction per die is set from (-5.56 $\varepsilon$ +32.5)% to (-6.22 $\varepsilon$ +43)% for dies at which $\varepsilon$ is more than 2.25 except for the final die,

④ reduction per die is set from 4% to (-8.3 $\varepsilon$+40.6)% for the final die, and

⑤ $\varepsilon$ at the final die is set from 3.0 to 4.3,

wherein $\varepsilon$ is drawing strain expressed by a formula $\varepsilon = 2\ln(d_0/d)$ [(4)], $d_0$ is diameter of the steel wire material in mm before drawing, d is diameter of the steel wire in mm after passing through a die, and ln means natural logarithm.
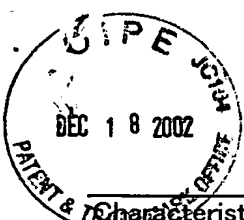
## Table 7

| Characteristc | Sample 37 | Sample 38 | Sample 39 | Sample 40 | Sample 41 | Sample 42 | Sample 43 | Sample 44 | Sample 45 |
|---|---|---|---|---|---|---|---|---|---|
| Structure | 2+1 | 2+1 | 2+1 | 2+1 | 2+1 | 2+1 | 2+1 | 1*3 | 1*4 |
| Wire Diameter (mm) | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.25 |
| Tensile Strength (N/mm$^2$) | 3548 | 3548 | 3548 | 3548 | 3548 | 3616 | 3175 | 3548 | 3254 |
| Cord Diameter (mm) | 0.574 | 0.569 | 0.57 | 0.576 | 0.572 | 0.576 | 0.572 | 0.601 | 0.612 |
| Winding Pitch | 14 | 16 | 18 | 12 | 20 | 16 | 16 | 10 | 10 |
| Winding Angle (° ) | 3.77 | 3.25 | 2.90 | 4.43 | 2.63 | 3.33 | 3.28 | 5.76 | 6.49 |
| Minimum Radius of Curvature (mm) | 33.92 | 45.02 | 56.75 | 24.79 | 69.54 | 43.96 | 44.56 | 15.94 | 14.18 |
| Minimum Radius of Curvature / Wire Diameters | 121.1 | 160.8 | 202.7 | 88.5 | 248.4 | 157.0 | 159.1 | 56.9 | 56.7 |

## Table 8

| Characteristc | Sample 46 | Sample 47 | Sample 48 | Sample 49 | Sample 50 | Sample 51 |
|---|---|---|---|---|---|---|
| Structure | 2+1 | 2+1 | 2+1 | 2+1 | 2+1 | 1*3 |
| Wire Diameter (mm) | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 |
| Tensile Strength (N/mm$^2$) | | | | | | |
| Cord Diameter (mm) | 0.472 | 0.47 | 0.47 | 0.473 | 0.471 | 0.494 |
| Winding Pitch | 12 | 14 | 16 | 14 | 14 | 10 |
| Winding Angle (° ) | 3.63 | 3.08 | 2.70 | 3.12 | 3.10 | 4.74 |
| Minimum Radius of Curvature (mm) | 30.27 | 41.49 | 54.16 | 40.98 | 41.32 | 19.32 |
| Minimum Radius of Curvature / Wire Diameters | 131.6 | 180.4 | 235.5 | 178.2 | 179.7 | 84.0 |

## Table 9

| Characteristc | Sample 52 | Sample 53 | Sample 54 |
|---|---|---|---|
| Structure | 2+1 | 1*3 | 1*4 |
| Wire Diameter (mm) | 0.32 | 0.32 | 0.3 |
| Tensile Strength (N/mm$^2$) | | | |
| Cord Diameter (mm) | 0.657 | 0.69 | 0.726 |
| Winding Pitch | 16 | 12 | 10 |
| Winding Angle (°) | 3.79 | 5.53 | 7.62 |
| Minimum Radius of Curvature (mm) | 38.65 | 19.90 | 12.11 |
| Minimum Radius of Curvature / Wire Diameters | 120.8 | 62.2 | 40.4 |

## Table 10

| Characteristc | Sample 55 | Sample 56 |
|---|---|---|
| Structure | 2+1 | 1*3 |
| Wire Diameter (mm) | 0.35 | 0.35 |
| Tensile Strength (N/mm$^2$) | | |
| Cord Diameter (mm) | 0.72 | 0.757 |
| Winding Pitch | 20 | 12.5 |
| Winding Angle (°) | 3.33 | 5.84 |
| Minimum Radius of Curvature (mm) | 54.95 | 19.65 |
| Minimum Radius of Curvature / Wire Diameters | 157.0 | 56.1 |